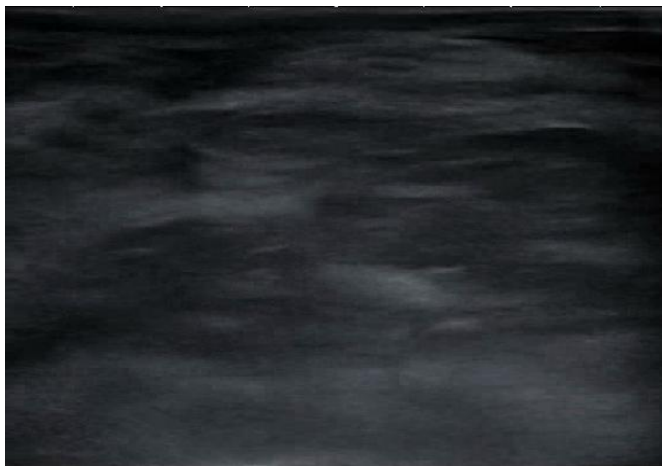


Iterative Spectral Clustering for Ultrasound Image Segmentation

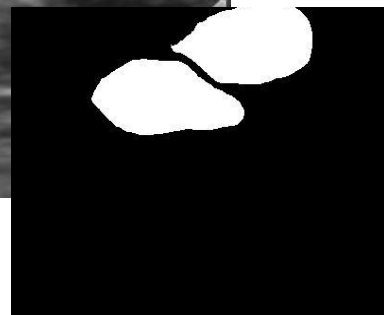
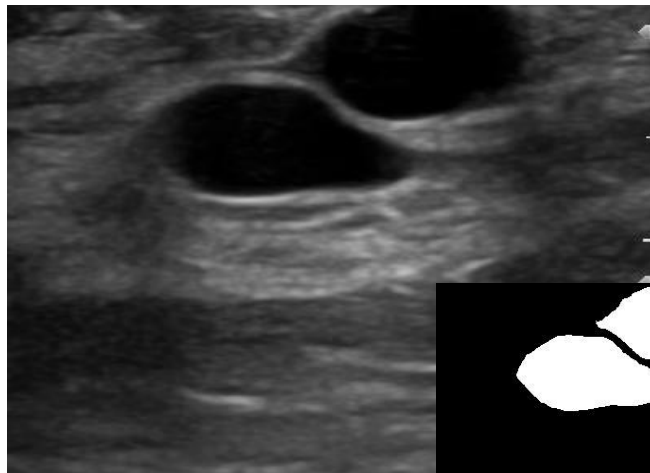
Paul Gamble, MD
In-Q-Tel, Lab 41

Build a classifier for ultrasound screening images

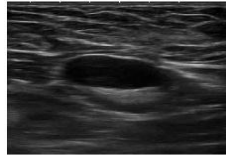
normal



lesion

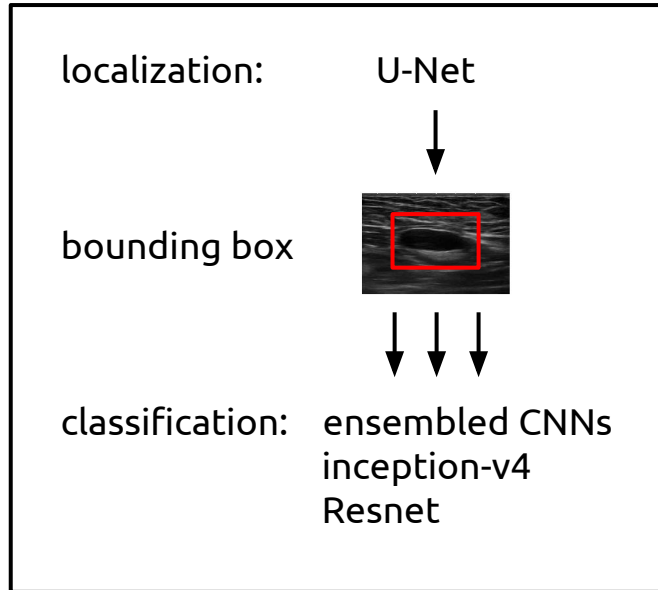


hand-drawn mask

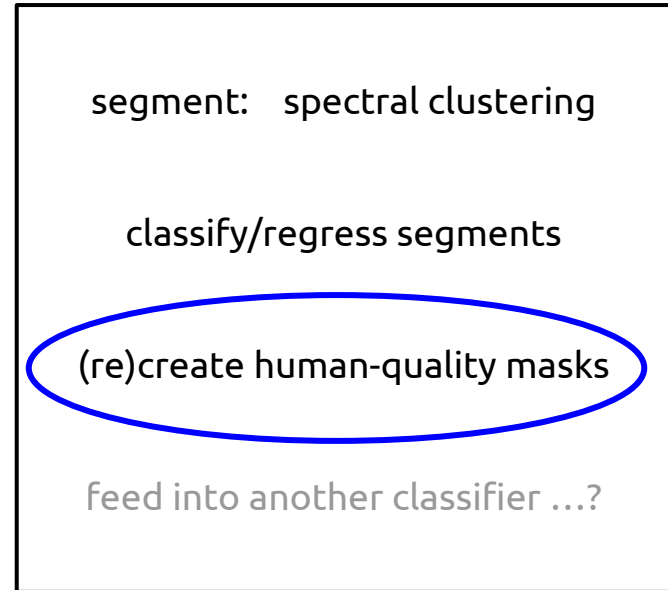


classify: normal or suspicious

deep network approach



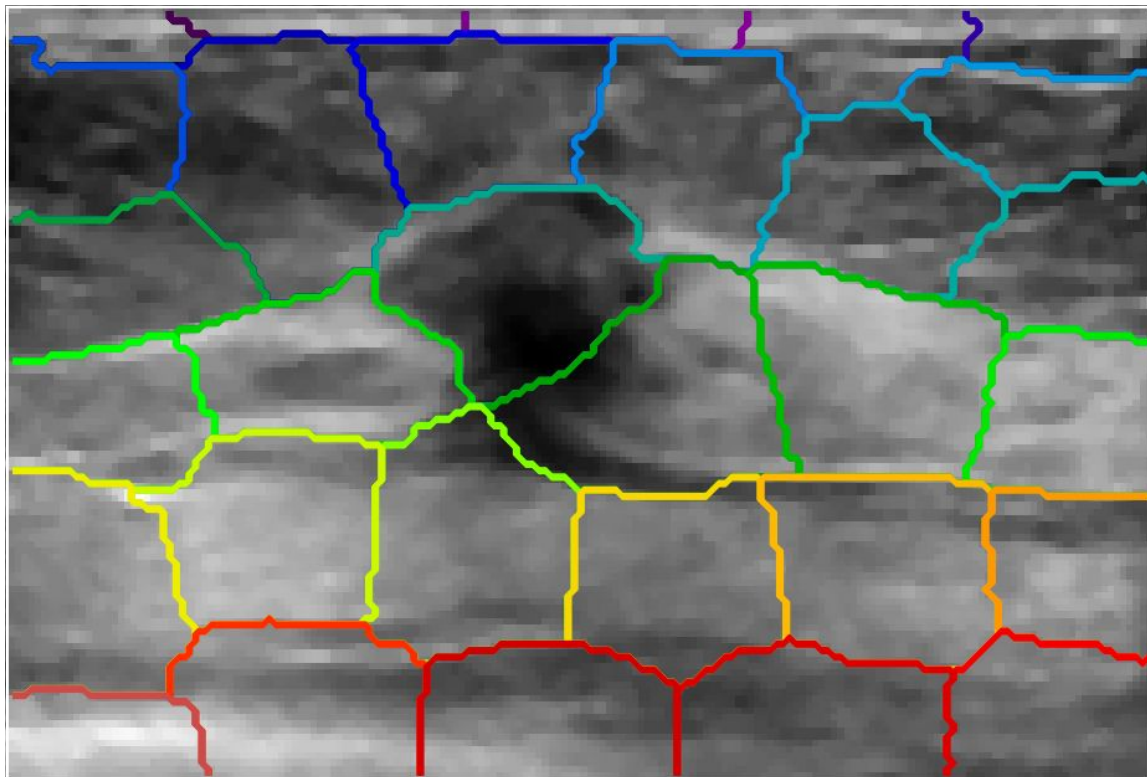
bespoke method

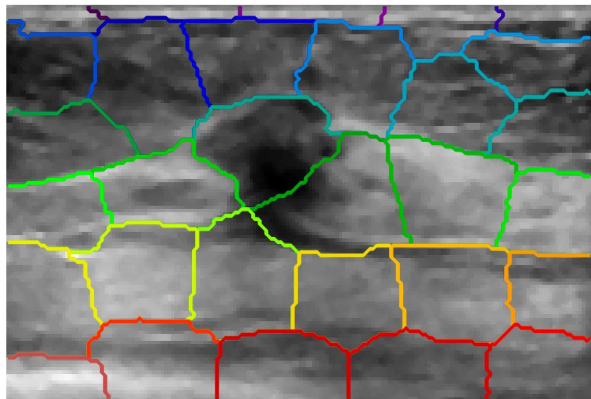






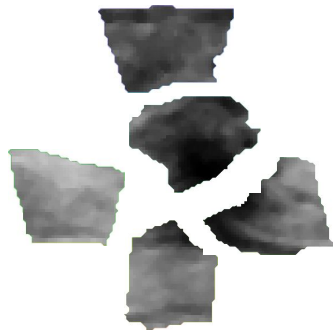
spectral clustering



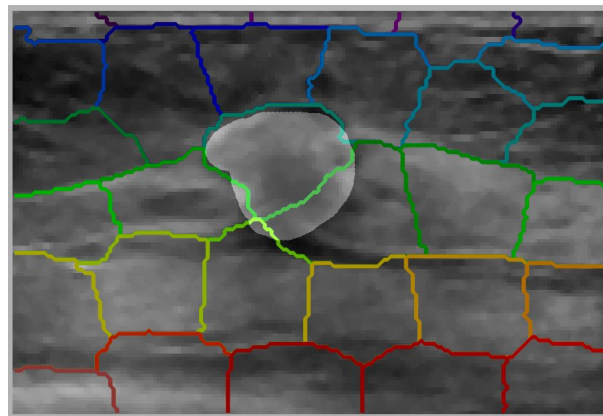
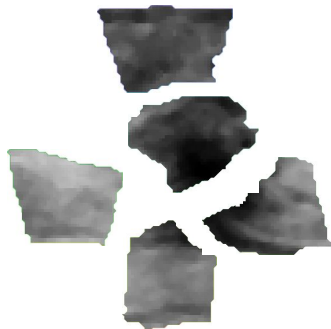


featurize segments

shape, intensity, variance, compare
with neighboring segments

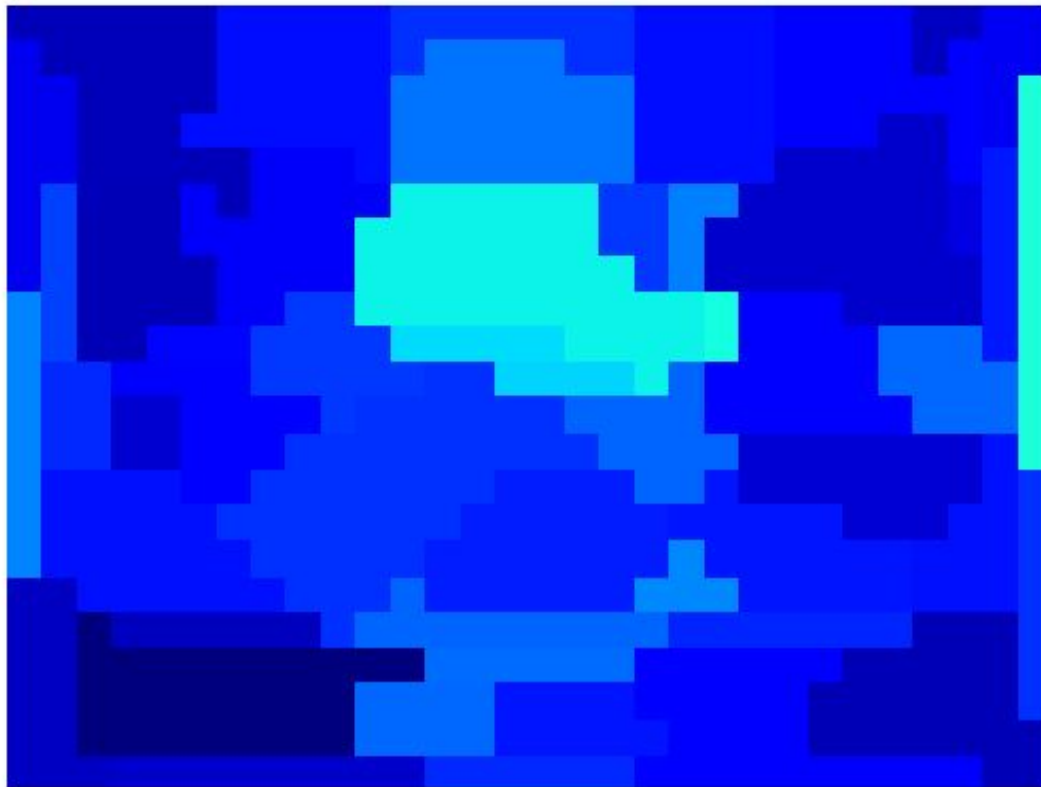


shape
location in image
overall intensity
measures of variance
borders
local/global segment
comparisons



fraction of segment
covered by mask

train Gradient Boosted Regressor

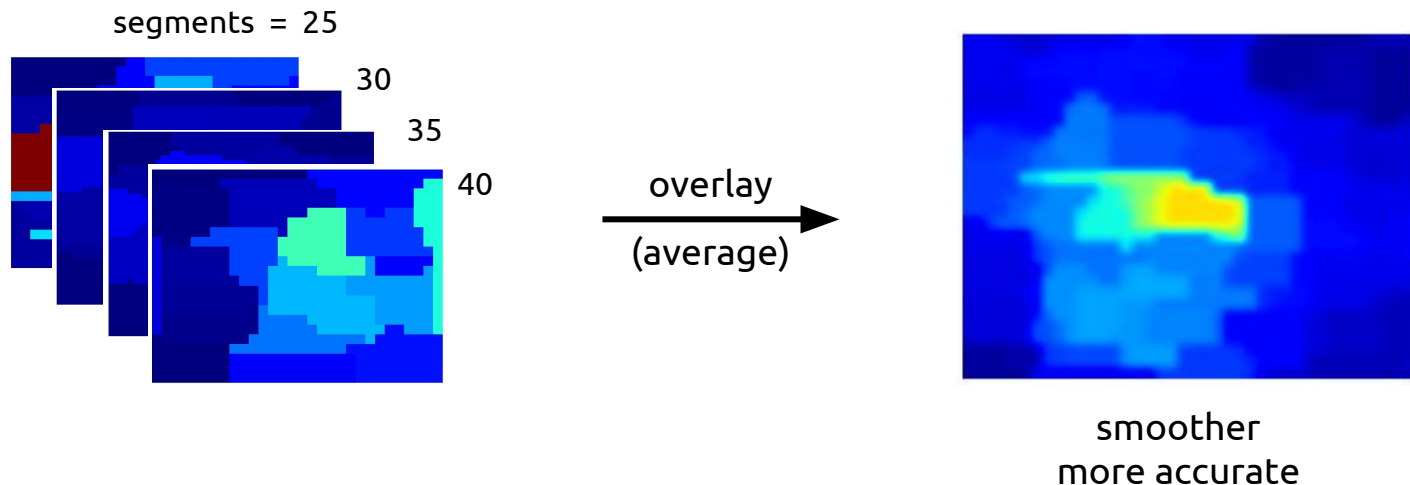




Iterative Spectral Clustering

vary segment # and clustering parameters

generate multiple heatmaps

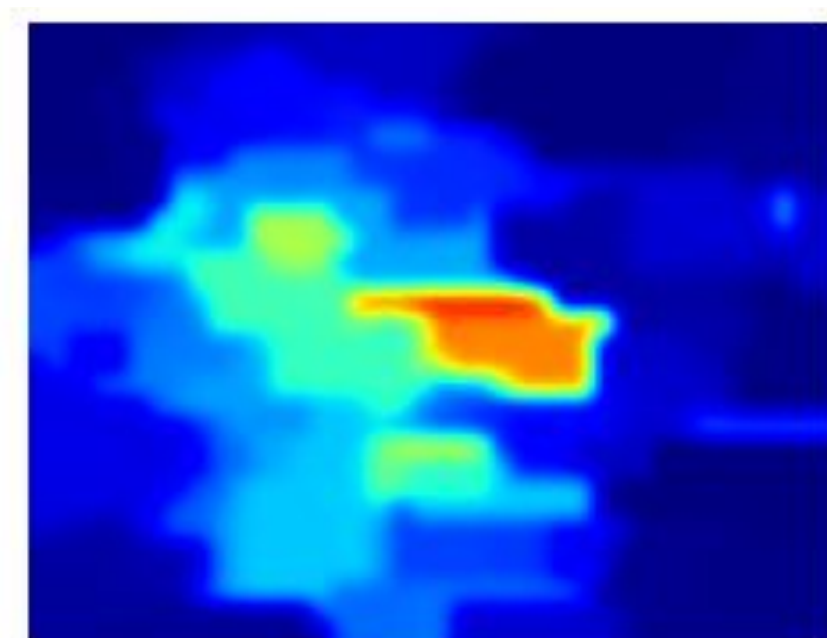
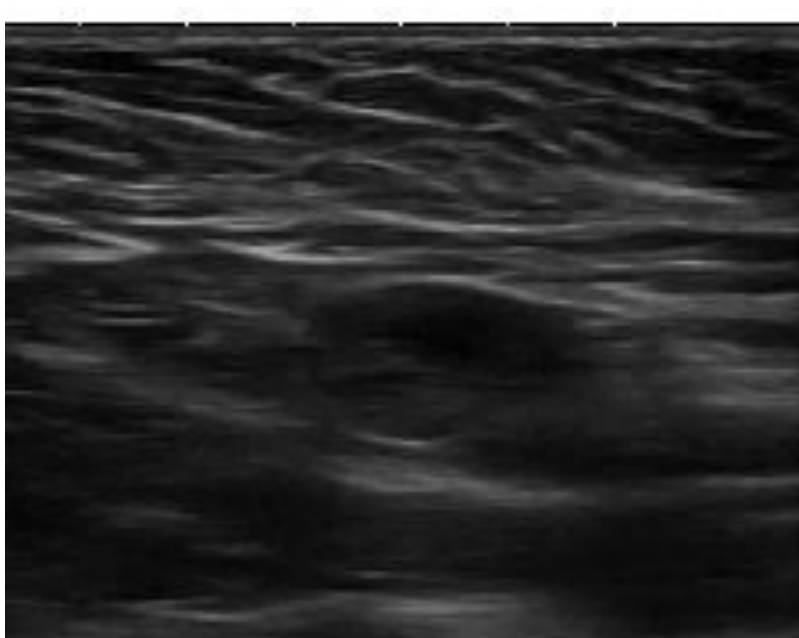


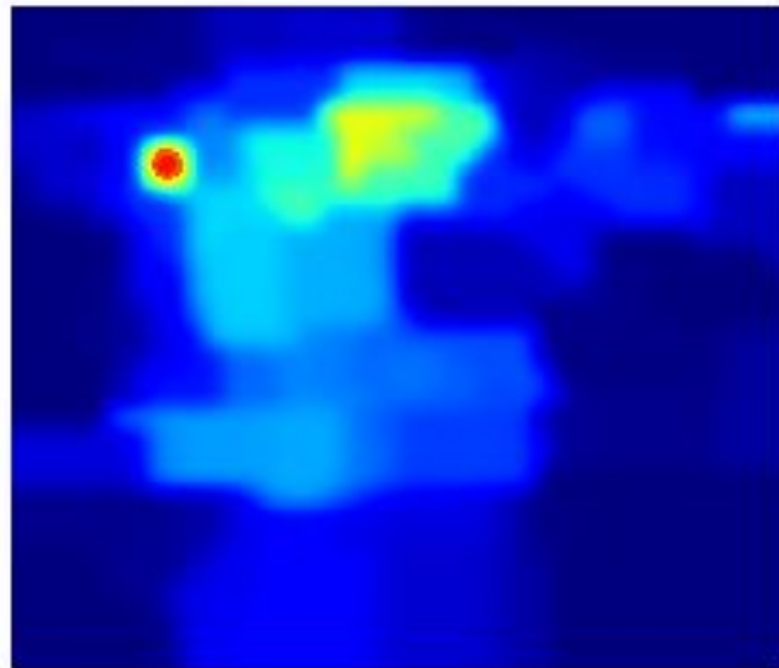
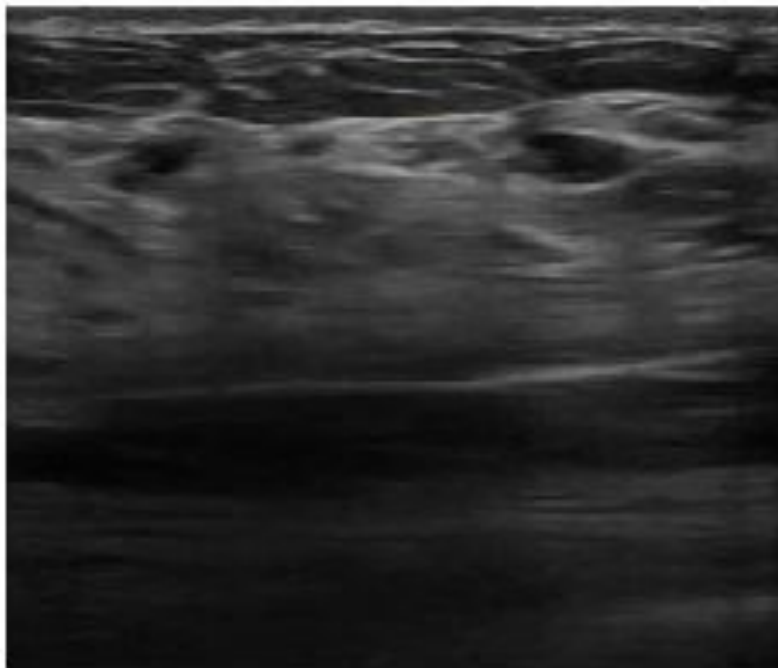


featurize each heatmap



train XGBoost Classifier





Segment Confusion

		Mask		
		1	0	
Model	1	139	94	0.597 PPV
	0	42	422	0.909 NPV
		0.768	0.817	0.805 Accuracy
		Sensitivity	Specificity	

1 : segment heat (mask fraction regressor output) > 0.15

Multi-Regressor Image Confusion

		Hand Label		
Model		lesion	normal	
	lesion	299	14	0.954
	normal	26	268	0.920
		0.922	0.953	0.937
		Sensitivity	Specificity	

F2: 0.928